Image Enhancement With Median Method Filter And Multiscale Retinex With Color Restoration On Video Dataset

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ABSTRACT

Video as one of the information storage media, where the video is formed from a set of moving images against a certain time unit or called frame per second (fps). Information contained in the video can be reduced if the video quality is poor. In this study, video quality improvement was done using Median Filter method and Multiscale Retinex with Color Restoraion (MSRCR). Median Filter is used to reduce noise and MSRCR is used to adjust the video brightness.

In this study the dataset used is CCTV video recording. The process is done by doing noise reduction with Median Filter, followed by MSRCR method. there are several stages in the MSRCR method namely, Gaussian Surround, Single Retinex Scale, Multiscale Retinex, Color Restoration and Multiscale Retinex with Color Restoration.

Testing is done using the test funality and testing methods. The test method uses the value of Peak Signal to Noise Ratio (PSNR) and process timing. The value of PSNR is calculated by the average calculation, because the PSNR value in each frame is different but not significant. Based on the results of testing the highest PSNR value obtained is 19.6088 dB with the fastest process time is ± 4 minutes, with brighter results and colors close to the original color. But there is still a bit of noise in sight. As can be seen from the test is the PSNR value and the image will not change if the Beta value far exceeds the Alpha value, so if the Alpha value is greater than Beta it will produce sharper and brighter video and the color can be returned to the original color.

Keywords : Video Quality Improvement, Median Filter, Multiscale Retinex With Color Restoration, Color Restoration, PSNR

1. INTRODUCTION

Video is an electronic signal processing technology that represents moving images. Video can be used in engineering, science, production and security applications [1]. The video is basically composed of many images or images, then the image changes in units of time then the video has a frame per second (fps). One example of the use of video in the field of security is closed-circuit television (CCTV) or surveillance cameras. Surveillance camera is enabled to monitor the movement of objects in a particular place. Surveillance cameras are usually used more for stalking someone like in a bank, store or office. The surveillance camera is enabled to monitor the movement of a person or group of people. The camera is also used to recognize the object or someone by selecting or capture the video.

But the resulting image is sometimes not good ie there is blur (blur) noise (noise) or on image brightness. So the object is hard to see or recognize clearly. The results of the image is not good can be derived with image processing operations that improve image quality so that objects can be seen more clearly than the original image. The process of image quality improvement using methods that can reduce noise with the image results better than the original image, while in the process of image enlargement used a method based on color determination (color constancy) so that the color in the image can look better.

Research conducted by Christine Wulandari, Esti Suryani and Umi Salamah said that Median Filter method can remove noise salt and pepper so that the use method to detect the characteristic can work optimally [2]. The process of image enlargement using Multiscale Retinex with Color Restoration method, in a study conducted by Laurentius Kuncoro Probo Saputra said that Multiscale Retinex with Color Restoration method produces better image than Adaptive Multiscale Retinex method and is very supportive in the process of facial image search [3].

Based on these problems, the image improvement will be focused on reducing the noise intensity by using Median Filter method. The Median Filter method can reduce noise with a slight degree of opacity. The process of image enlargement using Multi Scale Retinex with Color Restoration (MSRCR) method that can brighten the image by restoring the original color but has good color determination. Testing will be done by testing the functionality and testing methods using the PSNR value and calculating the process wktu. Implementation of these methods to determine the performance and video produced after the video quality improvement process.

1.1 Video

Video is an electronic signal that represents moving images. The common use of video is television but video is also used in engineering, science, production, and security applications.

Digital video can be called a three-dimensional array of colored pixels. The array consists of two dimensions serving the spatial direction of moving images (horizontal and vertical) and one other dimension will represent the time domain.

Digital video consists of a series of digital images displayed at a constant speed, the image is called the frame and the unit of measure to calculate the average frame shown is called frame per second (fps). Each frame is a digital image consisting of a raster pixel and will have a width of W pixels and a height of H pixels, it can be said that the frame size is W x H [1].

1.2 Image Processing

Image processing is a branch of science informatics to improve image quality for better quality or more easily interpreted by humans or computers. The input and output of the image processing program is image [4].

There are two principal areas of application of digital cira processing: enhancement of pictorial information for human interpretation and image processing for the transmission, transmission and representation of perception equipments [5].

1.3 Image Enhancement

Image enhancement can have several purposes including:

1. The image has a better look according to human taste.
2. Imagery becomes easier to analyze by image-based automation process.
3. Eliminating unwanted artifacts or better known as noise.

The processes included in the image enhancement are among others:

1. Changing the brightness of the image (image brightness).
2. Improved contrast.
3. Noise reduction.
4. Image softening (image smoothing).
5. Image sharpening (image sharpening) [4].

1.4 MATLAB

MATLAB (Matrix Laboratory) is a programming for numerical analysis and computation, an advanced mathematical programming language formed on the basis of thinking using the properties and forms of matrices.

Matlab is a software developed by Mathworks, Inc. and is the most efficient software for numerical matrix based calculations. Thus if in the calculation we can formulate the problem into the matrix format, then matlab is the best software for its numerical solution.

Matlab which is a high-level programming language based on matrices is often used for numerical computing techniques, used to solve problems involving mathematical operations of elements, matrices, optimizations, approximations and others. Matlab is widely used in:

1. Mathematics and Computation
2. Development and Algorithm
3. Programming Modeling, simulation, and prototyping
4. Data analysis, exploration, and visualization
5. Numerical and statistical analysis
6. Developing technical applications [6]

2. RESEARCH CONTENTS

Problems raised in this study is the video quality of the CCTV is less good, that is, still have noise and brightness levels on the video is less good. So that information on the video can not be delivered properly, to improve video quality then applied Median Filter method to reduce noise and Multiscale Retinex with Color Restoration (MSRCR) to improve video brightness level. The analysis was performed using CCTV video dataset, with the aim of research to know the performance of both methods in improving image quality.

2.1 Input Video

Video inputs are videos that can be formatted .AVI, .MP4, .MPG. The size or resolution of the video used may vary such as, 512 x 288, 640 x 480, 854 x 480. The frame rates are used on datasets such as 25fps and 30fps.



Figure 1 Input Video

2.2 Median Filter Noise Reduction

The median filter is very popular in image processing. This filter can be used to remove noise spots. The better value used for a given pixel is determined by the median value of each pixel and the eight neighboring pixels in 8-neighboring [8]. Here is a mathematical Median Filter notation:

$$g(y,x)=\text{median}\{f(y-1,x-1),\ f(y-1,x),\ f(y-1,x+1),\ f(y,x-1),\ f(y,x),\ f(y,x+1),\ f(y+1,x-1),\ f(y+1,x),\ f(y+1,x+1)\} \quad (1)$$

In this process is done reduction of noise intensity by using Median Filter method. This process produces smooth images and tends to eliminate noise, but this method works well with noise salt and pepper. The steps taken Median Filter method is as follows:

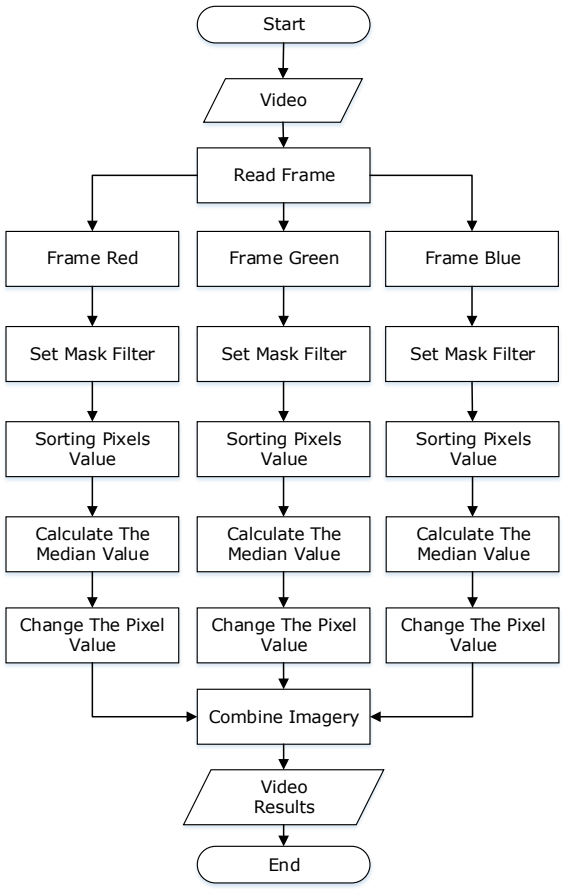


Figure 2 Flowchart Median Filter Color Image

Explanation of how Median Filter works is as follows:

1. Read the frame on the input video.
2. Separate frames based on color components ie Red, Green and Blue.

Then proceed with reading the pixel value. Here's an example of a pixel value matrix on frames based on RGB color components and has noise:

R : 177 G : 183 B : 197	R : 171 G : 179 B : 192	R : 161 G : 171 B : 183	R : 162 G : 174 B : 186
R : 173 G : 179 B : 195	**R : 45** **G : 53** **B : 66**	R : 165 G : 180 B : 187	R : 157 G : 174 B : 181
R : 157 G : 164 B : 183	R : 162 G : 175 B : 184	R : 208 G : 234 B : 231	R : 144 G : 174 B : 166
R : 167 G : 180 B : 197	R : 168 G : 185 B : 193	R : 140 G : 169 B : 164	R : 139 G : 171 B : 158

Figure 3 Matrix Of RGB Pixel Value

177	171	161	162
173	**45**	165	157
157	162	208	144
167	168	140	139

Frame Red

183	179	171	174
179	**53**	180	174
164	175	234	174
197	193	164	158

Frame Green

197	192	183	186
195	**66**	187	181
183	184	231	166
197	193	164	158

Frame Blue

Figure 4 Matrix Of Pixel Value

In the matrix there is noise, that is the value of RGB is significantly different. Frame Red there is a pixel value of 45, Green Frame is the value of pixel 53 and Frame Blue there is pixel value 66.

3. Sorting pixel value is entering pixel value read by mask done by equation (1) to take pixel value and inserted into matrix 1x9 which aims to facilitate sorting process or sorting, hence result of process can be described as follows:

177	171	161	162
173	**45**	165	157
157	162	208	144
167	168	140	139

Frame Red

183	179	171	174
179	**53**	180	174
164	175	234	174
197	193	164	158

Frame Green

197	192	183	186
195	**66**	187	181
183	184	231	166
197	193	164	158

Frame Blue

Figure 5 Placement Mask On Pixel Matrix

R :	45	157	161	162	165	171	173	177	208
G :	53	164	171	175	179	179	180	183	234
B :	66	183	183	184	187	192	195	197	231

Figure 6 Sorting on 1x9 Matrices

4. Calculate the median value using the equation as follows:

$$Median = \frac{n+1}{2} \quad (2)$$

Then the calculation becomes as follows:

$$Median = \frac{9+1}{2} = \frac{10}{2} = 5$$

Based on the calculation the median value is the 5th data on the matrix.

R :	45	157	161	162	165	171	173	177	208
G :	53	164	171	175	179	179	180	183	234
B :	66	183	183	184	187	192	195	197	231

Figure 7 Median Value In 1x9 Matrix

5. Replace the value of the center mask with the median value.

177	171	161	162
173	**165**	**45**	157
157	162	208	144
167	168	140	139

Frame Red

183	179	171	174
53	**179**	180	174
164	175	234	174
197	193	164	158

Frame Green

197	192	183	186
195	**187**	**66**	181
183	184	231	166
197	193	164	158

Frame Blue

Figure 8 Change the Mask Center Value

R : 177 G : 183 B : 197	R : 171 **G : 53** B : 192	R : 161 G : 171 B : 183	R : 162 G : 174 B : 186
R : 173 G : 179 B : 195	**R : 165** G : 179 **B : 187**	**R : 45** G : 180 **B : 66**	R : 157 G : 174 B : 181
R : 157 G : 164 B : 183	R : 162 G : 175 B : 184	R : 208 G : 234 B : 231	R : 144 G : 174 B : 166
R : 167 G : 180 B : 197	R : 168 G : 185 B : 193	R : 140 G : 169 B : 164	R : 139 G : 171 B : 158

Figure 9 RGB Frame After Repairing the Noise

2.3 Multiscalse Retinex With Color Restoration

Retinex theory was described by Edwin H. Land in 1971. The word "Retinex" is a combination of words formed from the words "Retina" and "Cortex", which indicates that both the eye and the brain are involved in processing. Retinex Theory is a theory based on color determination "Color Constancy" based that the perception of the human eye on the color depends on the reflection of the object's surface characteristics, and not related to the incident.

There are several developments in Retinex theory, Single-Scale Retinex (SSR), Multi-Scale Retinex (MSR), and Multi-Scale Retinex with Color Restoration (MSRCR). MSRCR has better results than other retinex types, but can not maintain the pattern reset so there is still a bit of color distortion [7]. The stages performed on MSRCR are as follows:

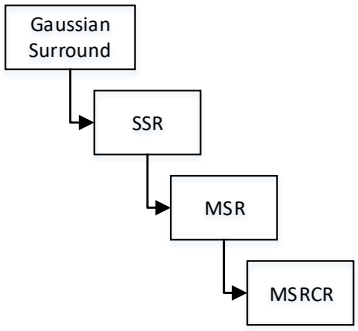


Figure 10 MSRCR Stages

2.4 Contrasting Image (MSRCR)

This process is done contrasting image using Multiscale Retinex with Color Restoration (MSRCR) method. The resulting image has a good level of brightness while still maintaining color decisions. The stages of the MSRCR method are as follows:

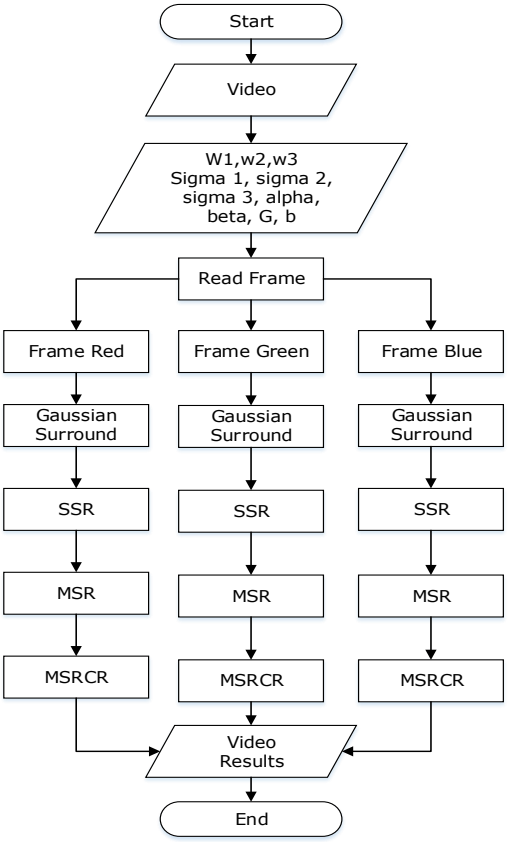


Figure 11 Flowchart Of MSRCR

2.4.1 Calculate Gaussian Surround

Gaussian Surround is used as a filter to refine the original image. This stage will be used for the SSR process [7]. The formula used is as follows:

$$F(x,y)=Ke^{-(x^2+y^2)/(2\times\sigma^2)} \quad (3)$$

Here is an explanation of the equation:
F(x,y) = Gaussian on pixel (x,y)
e = exponential
(x,y) = pixel coordinates
σ = sigma value

The first step taken to improve the video brightness is Gaussian Surround. This stage is intended to refine the video first. Gaussian value is obtained from equation (3) and uses three sigma values. By default the three sigma values used are as follows:

$\sigma 1 = 15$
$\sigma 2 = 80$
$\sigma 3 = 250$

But the value can be changed as needed.
Here's an example of calculating the value of Gaussian using the value of the first sigama is 15:

$$\begin{bmatrix} e^{-\frac{1^2+-1^2}{2(15)^2}} & e^{-\frac{1^2+0^2}{2(15)^2}} & e^{-\frac{1^2+1^2}{2(15)^2}} \\ e^{-\frac{0^2+-1^2}{2(15)^2}} & e^{-\frac{0^2+0^2}{2(15)^2}} & e^{-\frac{0^2+1^2}{2(15)^2}} \\ e^{-\frac{-1^2+-1^2}{2(15)^2}} & e^{-\frac{-1^2+0^2}{2(15)^2}} & e^{-\frac{-1^2+1^2}{2(15)^2}} \end{bmatrix}$$

The results are as follows:

$$\begin{bmatrix} 0{,}996565417 & 0{,}997780245 & 0{,}995565417 \\ 0{,}997780245 & 1 & 0{,}997780245 \\ 0{,}995565417 & 0{,}997780245 & 0{,}995565417 \end{bmatrix}$$

Total = 8,97338265
The total value of the matrix must be equal to 1, if it does not meet then it should be normalized by the formula:

$$a_{(x,y)} = \frac{a}{sum\,(a)} \quad (4)$$

Example:

$$a_{(1,1)} = \frac{0.995565417}{8.97338265} = 0{,}110946502$$

$$a_{(1,2)} = \frac{0{,}997780245}{8.97338265} = 0{,}111193324$$

$$a_{(1,3)} = \frac{0.995565417}{8.97338265} = 0{,}110946502$$

Calculation done on all elements of matrix, so got result as follows:

$$\begin{bmatrix} 0{,}110946502 & 0{,}111193324 & 0{,}110946502 \\ 0{,}111193324 & 0{,}111440695 & 0{,}111193324 \\ 0{,}110946502 & 0{,}111193324 & 0{,}110946502 \end{bmatrix}$$

Figure 12 Gaussian Kernel σ1=15

The calculation is done with the value σ2 = 80 and σ3 = 250.

2.4.2 Calculate SSR

Multiscale Retinex (MSR) basically uses the Singlescale Retinex (SSR) method but with different scales [7]. The equation of SSR is as follows:

$$R_i(x,y) = \log I_i(x,y) - \log[F(x,y) * I_i(x,y)] \quad (5)$$

Here is an explanation of the equation:
$R_i(x,y)$ = retinex output
$I_i(x,y)$ = image distribution in the i(x,y)
$*$ = convolution operator
i = color channel (R,G,B)

The initial stage of the SSR method is to convene the original image matrix with the gausian kernel found in (5). The original image matrix used is the image matrix of each color channel. The formula used for the calculation of convolution is as follows:

$$F(x,y) * I_i(x,y) \quad (6)$$

Here is an explanation of the equation:
F(x,y) = Gaussian Channel
"*" = Convolution
$I_i(x,y)$= matrix if image
i = color channel (R,G,B)

The convolution calculation on the image matrix of the resulting red image Median Filter is as follows:

0	0	0	0	0	0
0	177	171	161	162	0
0	173	165	45	157	0
0	157	162	208	144	0
0	167	168	140	139	0
0	0	0	0	0	0

$$\begin{bmatrix} 0{,}110946502 & 0{,}111193324 & 0{,}110946502 \\ 0{,}111193324 & 0{,}111440695 & 0{,}111193324 \\ 0{,}110946502 & 0{,}111193324 & 0{,}110946502 \end{bmatrix}$$

Here's the calculation of frame red convolution with value $\sigma 1 = 15$
(0 x 0,110946502) + (0 x 0,111193324) +
(0 x 0,110946502) + (0 x 0,111193324) +
(177 x 0,111440695) + (171 x 0,111193324) +
(0 x 0,110946502) + (173 x 0,111193324) +
(165 x 0,110946502) = 76,2816793

The calculation is done by shifting the right one pixel.

Once the rightmost pixel is exhausted, it moves down a pixel from the initial pixel.
So the results obtained as follows:

76,2816793	99,17293825	95,69780201	58,40546221
111,7098941	157,6506271	152,7442329	97,46430508
110,2604229	153,9132463	147,5609364	92,61399825
72,72175969	111,3671789	106,8158888	70,14603304

Figure 13 Results of the Frame Red Convolution σ1=15

Calculations are also performed using σ2 = 80 and σ3 = 250. So also on Frame Green and Frame Blue.

2.4.3 Calculate MSR

The idea from the basis of Multi-Scale Retinex for SSR problems is found on different scales used and given different weights to combine the advantages and eliminate the weaknesses of both low and large scale [7]. The equations of MSR are as follows:

$$R_{MSR_i}(x,y) = \sum_{n=1}^{N} W_n \, R_{n_i} \quad (7)$$

Here is an explanation of the equation:

R_{MSR_i} = MSR output
N = number of scales
Wn = the weights associated with the nth scale
R_{n_i} = output of the SSR associated with the nth scale
i = color channel (R,G,B)

The initial stage of the MSR method is to determine the weights to be used. There are 3 weights to use. Each weight will be multiplied by the result of each SSR then summed.
Sample weighting:
W1 = 0,33
W2 = 0,34
W3 = 0,33
Weight values can be tailored to the needs.
Based on (7) N = 3. Then if the equation is described it will be as follows:

$$R_{MSR_i}(x,y) = W_1 \times SSR1 + W_2 \times SSR2 + W_3 \times SSR3$$

Clculate MSR on Frame Red

0,365553021	0,23660293	0,225923913	0,443061549	
0,189954463	0,019788242	-0,530752308	0,207054062	X 0,33
0,153479999	0,022239016	0,149091932	0,191685859	
0,361052092	0,178552063	0,117492177	0,297011685	

SSR1

0,36587976	0,23686424	0,226060268	0,44357935	
0,19011664	0,01974561	-0,53084433	0,20713946	X 0,34
0,1536252	0,02230533	0,149107215	0,19195036	
0,36136966	0,17867943	0,117641707	0,29722035	

SSR2

76,22243604	99,11133348	95,66677862	58,33359273	
111,6668221	157,666609	152,7776572	97,44451584	X 0,33
110,2223596	153,8889765	147,5555749	92,55576577	
72,66686479	111,333455	106,7779149	70,11123668	

SSR3

After the calculation maska obtained results from MSR Frame Red is as follows:

25,39843551	32,86535286	31,72145233	19,54711289
36,97737592	52,0432246	50,06099154	32,29544548
36,47625964	50,79828493	48,79323651	30,67192216
24,22207826	36,85971334	35,31548252	23,33577688

Figure 14 MSR Frame Red

After getting the results, then performed normalization with the following formula:

$$MSR_i = 255 \times \frac{(x,y) - min}{max - min} \quad (8)$$

(x,y) = pixel value
min = the smallest pixel value
max = the bigest pixel value
Here are the results after the normalization process:

45,91587084	104,5094632	95,53316978	0
136,7768893	255	239,4452335	100,0373472
132,8445834	245,230843	229,4970423	87,29740928
36,68488649	135,8535801	123,7358577	29,72999742

Figure 15 Normalization MSR On Frame Red

Do the calculations on Green Frame and Blue Frame.

2.4.4 Perhitungan MSRCR

MSRCR merupakan pengembangan dari MSR, dimana metode ini mampu memperbaiki kualitas citra yaitu pada pencerahan citra dengan mempertahankan color constancy. Color constancy atau ketetapan diambil dari sistem penglihatan manusia yang mengusahakan warna dari suatu benda teteap terlihat sama walaupun pada kondisi pencahayaan yang berbeda-beda [7].

Sebelum melakukan perhitungan MSRCR, terlebih dahulu harus melakukan perhitungan untuk Color Restoration (CR). Adapun persamaan dari CR adalah sebagai berikut:

$$C_i(x,y) = \beta \left\{ \log[\alpha I_i(x,y)] - \log[\sum_{i=1}^{S} I_i(x,y)] \right\} \quad (9)$$

Or it can be described as follows:

$$C_i(x,y) = \beta(\log(\alpha I_i(x,y)) - \log(I_R(x,y) + I_G(x,y) + I_B(x,y)))$$

Here is an explanation of the equation:

β = gain constant

α = nonlinearity control constant
S = 3, color channel (R,G,B)

The initial stage of MSRCR calculation is to process the color restoration first. Previously there are parameters that must be established first ie:

β = 46

α = 125

Alpha and beta values can be tailored to the needs.

The next stage is the MSRCR calculation. the equation of MSRCR is as follows:

$$R_{MSRCR_i}(x,y) = G\left[C_i(x,y)R_{MSR_i}(x,y) + b\right] \quad (10)$$

G and b is final gain and offset values

Here are the values of the parameters G and b:

G = 192

b = -30

But the value can be adjusted as needed.

Here are the results after quality improvement:

R : 177 G : 183 B : 197	R : 171 G : 179 B : 192	R : 161 G : 171 B : 183	R : 162 G : 174 B : 186
R : 173 G : 179 B : 195	R : 45 G : 53 B : 66	R : 165 G : 180 B : 187	R : 157 G : 174 B : 181
R : 157 G : 164 B : 183	R : 162 G : 175 B : 184	R : 208 G : 234 B : 231	R : 144 G : 174 B : 166
R : 167 G : 180 B : 197	R : 168 G : 185 B : 193	R : 140 G : 169 B : 164	R : 139 G : 171 B : 158

Original Image

R : 177 G : 183 B : 197	R : 171 G : 53 B : 192	R : 161 G : 171 B : 183	R : 162 G : 180 B : 186
R : 173 G : 179 B : 195	R : 157 G : 175 B : 66	R : 162 G : 174 B : 184	R : 45 G : 174 B : 231
R : 157 G : 164 B : 183	R : 165 G : 179 B : 187	R : 208 G : 174 B : 181	R : 144 G : 234 B : 166
R : 167 G : 180 B : 197	R : 168 G : 185 B : 193	R : 140 G : 169 B : 164	R : 139 G : 171 B : 158

Median Filter

R : 46 G : 255 B : 233	R : 105 G : 182 B : 194	R : 96 G : 158 B : 191	R : 0 G : 224 B : 255
R : 147 G : 0 B : 194	R : 255 G : 111 B : 131	R : 194 G : 116 B : 0	R : 100 G : 155 B : 187
R : 176 G : 165 B : 174	R : 245 G : 105 B : 130	R : 229 G : 142 B : 164	R : 86 G : 160 B : 180
R : 36 G : 239 B : 235	R : 135 G : 169 B : 178	R : 122 G : 148 B : 164	R : 30 G : 205 B : 213

MSRCR

Figure 16 Comparison of Pixel Matrices

2.5 Testing

Testing is done to find out whether the applied method runs in accordance with the purpose or not. The process of testing method is done by calculating the process time and using Peak Signal to Noise Ratio (PSNR) where to get the value of PSNR must first calculate the value of Mean Squared Error (MSE). The formula of MSE is as follows :

$$MSE = \frac{1}{n}\sum_{i=1}^{n}(f_i - y_i)^2 \quad (11)$$

And the PSNR formula is as follows:

$$PSNR = 10\log_{10}\left(\frac{C_{max}^2}{MSE}\right) \quad (12)$$

The test was performed on 3 data with each 5 test.

Table 1 Testing On 1st Data

No	Alpha	Beta	PSNR	Process Time
1	50	100	19.0464 dB	308 Second
2	30	30	19.0743 dB	417 Second
3	115	100	18.7869 dB	292 Second
4	34	33	19.09 dB	424 Second
5	255	255	18.5328 dB	310 Second

Table 2 Testing On 2nd Data

No	Alpha	Beta	PSNR	Process Time
1	100	50	14.8 dB	373 Second
2	225	225	15.6297 dB	339 Second
3	100	100	15.251 dB	345 Second
4	255	100	15.6297 dB	361 Second
5	55	105	14.8743 dB	359 Second

Table 3 Testing On 3rd Data

No	Alpha	Beta	PSNR	Process Time
1	100	50	19.1444 dB	411 Second
2	30	30	19.5561 dB	290 Second
3	28	100	19.6088 dB	281 Second
4	255	255	18.2844 dB	398 Second
5	29	255	19.5826 dB	398 Second

Based on the results of the tests that have been done, the third largest PSNR video is owned by the third video on the 19,8888 dB test and the fastest process time is ± 4 minutes.

3. Conclusion

Based on the test results obtained the largest PSNR is 19.6088 dB with the fastest process time is ± 4 minutes, but it can be concluded the value of PSNR is higher than the resemblance of the video results with the original video.

The PSNR value is the result of the average PSNR calculation on all video frames, the calculation is done because the PSNR value on each frame is different but not significant. If not done the calculation of the average PSNR value will be very large in number.

As can be seen from the test is, if the Alpha value is greater than Beta then it will produce a sharper, brighter video and detailed images will be seen, but there is still a little noise. The value of PSNR will not increase if the Beta value far exceeds the Alpha value, the resulting image will not change.

Applications built there are still shortcomings and can be done further development to get better results. Suggestions for further development that can be taken into consideration that is:

1. More variables can be created dynamically according to user needs.
2. Using a combination of other methods to reduce noise or to improve the video brightness.
3. Using other testing methods that are more optimal in the testing phase of video repair results.
4. Applications can be developed with the detection of objects such as humans or face objects.

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